

Proposal of elements of analysis to know the level of energetic management

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ABSTRACT: *Proposals to combat climate change have many organizations, such as the Energy and Climate Partnership of the Americas (ECPA), which has established multiple initiatives, programs and actions as part of a clear strategy in relation to the management of climate change. energy (GE) in companies. The importance of working in the development of the EG is that through it opportunities are detected in aspects related to the improvement of production processes, the quality and safety of the energy system, allowing this, that users enter the system, identify levels of consumption and raise awareness to implement improvements that result in high levels of energy efficiency. The objective of this work was to offer a proposal that companies can take to carry out improvement actions, especially those that are beginning in the introduction of the EG, establishing elements to develop the EG in the organizations and above all as a guide of support to contribute with the discovery of the level of energy management that we have, as a base that helps companies in their task of making rational and efficient use of their energy.*

KEYWORDS: *Energies, management elements, energy management, proposals.*

I. INTRODUCTION

Within the demands of today's world there are challenges for both advanced economies and emerging economies. In this future, in order to achieve growth that will allow it to progress at the level of developing countries, many countries will have to carry out actions that allow healthy growth in terms of sustainability, innovation and sustainability. The reality of climate change is already a tangible fact. The most extreme weather conditions are no longer a prediction: they are real and are happening today. Actions are needed to prevent the situation from getting worse. During 2018, there are several opportunities to raise awareness about solutions, demonstrate progress and increase the ambition to do more, from now on [1].

Energy is the consequence of acting through interactions or exchanges of the four types of fundamental forces of nature: gravitational, electromagnetic, strong nuclear and weak nuclear. [2]. One of the challenges facing the planet today is the great demographic growth, for example, in Latin America and the Caribbean it is estimated that between 2011 and 2030 electricity consumption will grow by 80%, since population growth will increase the use of electrical and household appliances, there will be greater industrial activity that will cause a greater demand for energy, so that the sustainable way through the adoption of renewable energies, will not exacerbate the effects of climate change[3].

According to the Climate Group, global demand forecasts will increase by 37% from 2013 to 2035, at an average of 1.4% per year. Due to the problem of energy demand, governments and organizations in developed countries are increasingly committed to campaigns and actions in favor of energy efficiency [4]. Unfortunately, in Latin American countries the lack of campaigns and actions aimed at promoting the conscious and rational use of energies prevails and this has an extremely negative impact on the environment that surrounds us [5].

A clear example of proposals to combat climate change is the Energy and Climate Partnership of the Americas (ECPA), which has established multiple initiatives, programs and actions as part of a clear strategy in relation to energy management in the Americas. Companies, part of these projects are: Promotion of metrology applied to the measurement and evaluation of the compliance of the efficiency (2016-2020), by strengthening the capabilities of measurement and assessment of the compliance of energy efficiency in equipment and household appliances; Promotion of metrology for the promotion of sustainable energy technologies in the Western Hemisphere (2016-2020). The initiative promotes the deployment of sustainable energy technologies and fosters sustainable development by promoting the strengthening of measurement capabilities associated

with energy efficiency, renewable energies and air quality); Production in Closed Cycle in the Americas (2009-2016), The initiative aims to promote, introduce and apply the concept of 'Production in Closed Cycle' in the productive sector of nations in the Americas and facilitate the transition to circular economies in the region [6]. In Mexico, the National Commission for the Efficient Use of Energy (CONUEE) since 2011 points out that there are few companies that know that their energy consumption represents between 5 and 20% of their expenses, even their vision is that between The more energy they have, the more productive the business is [7]. This translates into high costs for the sector, the generation of strong amounts of polluting emissions and the unlimited consumption of limited resources, non-renewable and for which there are still no substitutes, so it is essential that companies analyze that the reduction of its consumption, reduce its costs, increase its operations and reduce its participation in the greenhouse effect [8]. It is important to take into account the use of tools, methods and models that are offered in the GE, Mayo et al. [9] reviewed the literature from 1995 to 2015 and identified four key aspects of energy management for manufacturing, see Table 1.

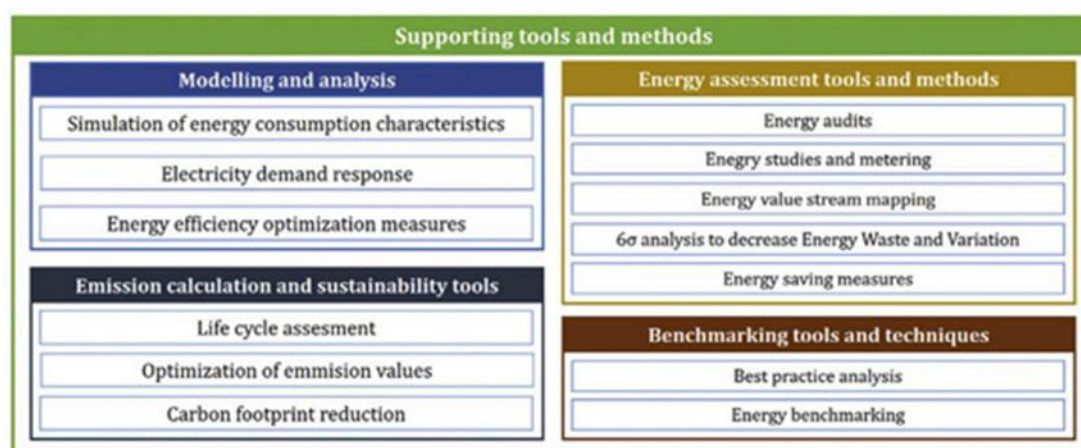


Table 1. Tools and support methods to support the management of energy in manufacturing, as identified in the current literature

Source: Mayo et al., 2017.

The foregoing intends to state that today there is a concern and occupation in much of the world for collaborating in the improvement of energy management (GE) from projects that contribute to achieving not only optimization in the use of energy, but also , in developing practices that allow its adequate and efficient use, without diminishing the level of benefits. The importance of working in the development of the EG is that through it are detected opportunities for improvement in aspects related to the improvement of production processes, the quality and safety of the energy system, allowing this, that users enter the system, identify levels of consumption and raise awareness to implement improvements that result in high levels of energy efficiency. Therefore, it can be understood that through the GE it is possible to have an integrated study that analyzes the current situation of energy consumption and implements energy control systems. Simultaneously, it seeks alternatives in renewable energy sources and environmental protection, both in the design of the project and in the execution and coordination of the facilities. Therefore, the present work has the purpose of offering a proposal that companies can take to carry out improvement actions, especially those that are beginning in the introduction of the EG, to establish elements to develop the EG in the organizations and above all as a support guide to contribute with the discovery of the level of energy management that we have, as a base that helps companies in their task of making rational and efficient use of their energy.

II. METHOD

For the development of the present work, a mixed, descriptive and transversal research was generally established, which exposes the elements that can be considered more important to develop the EG in the companies, for which it relied on the use of collection sources of primary information, since I include the use of interviews with people, direct observation of companies, but also resorted to the use of secondary sources through the exploration of information present in the articles consulted, the official WEB pages of public and private institutions (all of them presented in the references at the end of this document).

Like all research work, a team of researchers and students of the master's degree program in Administrative Engineering from the Orizaba Technological Institute, who develop the line of generation and application of

business management knowledge and the sub-line of energy management. To achieve an order in the development of work, we followed the methodology offered by the cycle of an Energy Management System (SGEn) Analyze-Act- Supervise -To size (see fig. 1) which appropriately incorporates the management of the energy to the usual practices of the organization.



Fig 1: SGen cycle Source: AEM-Sistemas, 2017.

The work criteria for each stage of the PHVA cycle were established as follows:

- Analyze: carry out the review of the elements of energy management through the sources of information collection, in order to establish the collection and a concentration of the general elements of energy management.
- Act: with the help of quality tools, the basic or main elements were obtained to develop an adequate energy management.
- Supervise: to achieve the verification of the proposed elements, a comparison of these was made in relation to the benefits that energy management brings.
- Measure: in this aspect the action to be taken was established as the realization of the dissemination of energy management elements, which help to promote awareness and take actions to continuously improve and energy performance in companies.

III. RESULTS

The step analyzed consisted of searching information in various articles, web pages of government agencies, in business associations and directly in the field work in companies specifically in a region that includes the central area of the state of Veracruz, in Mexico. Everything was done during the period December-May 2019. A collaboration agreement was made with business chambers such as the National Chamber of the Transformation Industry (CANACINTRA) and the National Chamber of Commerce (CANACO) with headquarters in the cities of Córdoba and Orizaba. in the Mexican state of Veracruz. In the companies, unstructured interviews were conducted through which an open dialogue was achieved with the CEOs (Chief Executive Officer), COO (Chief Operating Officer), CFO (Chief Financial Officer), CTO (Chief Technology Officer), CIO (Chief Information Officer) and CMO (Chief Marketing Officer). Part of the questions asked to business managers were the following: Do you consider energy management important? Do you believe that your employees carry out energy management? What elements do you consider to achieve energy management? In your particular case Do you carry out energy saving activities? One way to observe the responses of the interviews is seen in the following diagram causes effect of Fig 2.

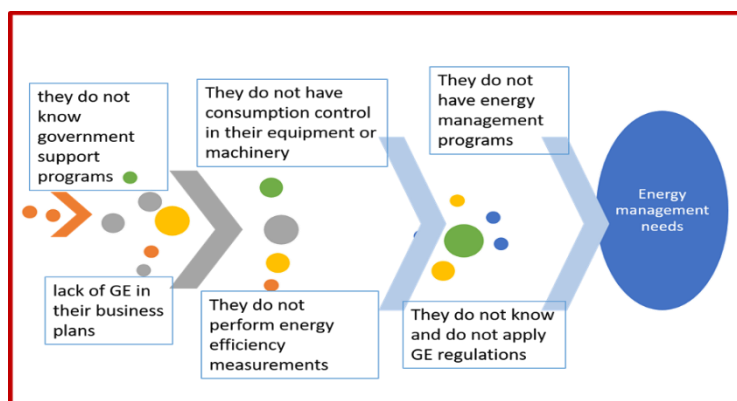


Fig 2. GE needs Source: self made

As can be seen in fig 2, the main causes that provoke the needs in terms of energy management, provided by the interviewees are: They do not know government support programs, They do not have control in their equipment or machinery, They do not have energy management programs, lack of GE in their business plans, they do not perform energy efficiency measurements and lack of GE in their business plans.

Regarding the step Actuar, the collection and concentration of information, the research team, through the observation and reading of the contents of primary and secondary information sources was achieved the detection of elements which the team structured type brainstorming and made a table of essential elements that under the focus of GE should consider and exist in companies to succeed in GE, the elements are presented in table 2 below:

Elements of Energy Management		
<ol style="list-style-type: none"> 1. Training Programs 2. Training courses 3. Recruitment process 4. Legislation 5. Regulations (country) 6. Government associations 7. Government programs 8. Non-governmental associations 9. Strategic alliances 10. Energy audits 11. Energy diagnostics 12. Definition of consumption 13. Administration of the consumptions 14. ISO 50001 standard 15. Type of productive process 16. Knowledge of international, national, state or municipal governmental initiatives 17. Link with IES (Institutions of higher education) 18. Use of government support to replace lighting and equipment 19. Use of training offered by government agencies or institutions on the subject 20. Use of service providers in terms of training 	<ol style="list-style-type: none"> 21. Use of service providers for the measurement of energy efficiency 22. Business economies (circular economies) 23. Energy control systems. 24. Size of the company 25. Sector to which the company is dedicated 26. Amount of energy consumed 27. Type of energy used 28. Cost of energy 29. Maintenance programs for equipment or machinery. 30. Equipment replacement programs 31. Programs of innovation and development of equipment or machinery 32. Organizational culture 33. Personal culture 34. Uses and customs of employees 35. Research and development 36. Level of technological lag 37. Increase in energy prices. 38. Number of cars and trucks 39. Quantity of machinery and equipment 40. Measurement of productivity 41. Decrease in energy costs 42. Utility margin 	<ol style="list-style-type: none"> 43. Use of software for measurement and control of energy consumption 44. Consumption measurement system 45. Methodologies for consumption measurement 46. Log of physical record of historical consumption data 47. Digital log of historical data 48. Assignment of personnel with established functions for registration, etc. 49. Contribution of greenhouse gases 50. Lack of knowledge of benefits and impacts 51. Use of methodologies such as Max-Min 52. Energy improvement plans 53. Economic investment 54. Level of awareness of CEOs, CIO ETC. 55. Form of use of energy. 56. Innovation development 57. Advice for development 58. Establishment of strategies 59. Use of TIC'S 60. Business policies

Table 2. Essential elements for GE achievement Source: self made

We obtained 60 essential elements that influence energy management, the question was: How to integrate and group the elements of GE? The supervision task was done taking what AEM-Sistema's [10]. proposes derived from the good experiences harvested in recent years by companies of all types have allowed to identify the

advantages of implementing these systems (SGEn) with respect to other types of actions. According to their benefits, they can be grouped around three main

concepts: Save: although it seems obvious, the pattern of continuous review (supervision) that the SGEn bet on makes it possible to multiply the identification and implementation of savings opportunities, linked both to the operation of equipment and facilities and the behavior of personnel. Systematize: The SGEn are a tool for the identification and implementation of saving measures in a systematic way. This systematization implies many advantages over other measures of saving and efficiency, which in many cases are applied in a timely manner. Demonstrate: The standards of energy management systems (ISO 50001) [11]. and their certification allow organizations to demonstrate their commitment to efficiency, quality and responsible environmental management policies that are beneficial to the environment.

The research team determined to group with a table of relationship to the elements for the GE which is presented in Table 3 below:

ELEMENTS OF ENERGY MANAGEMENT ENVIRONMENT TO THE THREE MAIN CONCEPTS OF SGEn		
Save	Systematize	Demonstrate
1. Training Programs 2. Training courses 3. Recruitment process 4. Strategic alliances 5. Definition of consumption 6. Knowledge of international, national, state or municipal governmental initiatives 7. Use of government supports to replace lighting and equipment 8. Use of training offered by government agencies or institutions in the field 9. Use of service providers in terms of training 10. Size of the company 11. Sector to which the company is dedicated 12. Organizational culture 13. Personal culture 14. Number of cars and trucks 15. Quantity of machinery and equipment 16. Uses and customs of employees 17. Research and development 18. Lack of knowledge of benefits and impacts 19. Energy improvement plans 20. Economic investment 21. Level of awareness of CEOs, CIO ETC. 22. Form of use of energy. 23. Innovation development 24. Advice for development 25. Establishment of GE strategies 26. Business policies	27. Use of software for measurement and control of energy consumption 28. Consumption measurement system 29. Energy audits 30. Energy diagnostics 31. Administration of the consumptions 32. Type of productive process 33. Link with Higher Education Institutions (IES) 34. Energy control systems 35. Maintenance programs for equipment or machinery. 36. Equipment replacement programs 37. Programs of innovation and development of equipment or machinery 38. Level of technological lag 39. Methodologies for consumption measurement 40. Log of physical record of historical consumption data 41. Digital log of historical data log 42. Assignment of personnel with established functions for registration, etc. 43. Use of methodologies such as Max-Min 44. Use of TIC'S	1. Use of service providers for the measurement of energy efficiency 2. Legislation 3. Regulations (country) 4. Government associations 5. Government programs 6. Non-governmental associations 7. ISO 50001 standard 8. Business economies (circular economies) 9. Amount of energy consumed 10. Type of energy used 11. Cost of energy 12. Increase in energy prices. 13. Measurement of productivity 14. Decrease in energy costs 15. Margin of utility 16. Contribution of greenhouse gases
INTERNAL ELEMENTS OF GE		EXTERNAL ELEMENTS OF GE

Table 3. Elements of GE vs. main concepts of SGEn Source: self made

For the development of the measure phase, it was observed in table 3, that the first two columns grouped the elements related to the concepts (of SGEn) saving and systematizing, had been grouped as "internal GE elements" and the corresponding elements the third column of the demonstration concept grouped the "GE external elements". Based on the above, the percentage of internal elements was calculated against the percentage of external elements of the total 60 elements of GE (table 1) and the following was obtained:

INTERNAL ELEMENTS OF GE = 44 REPRESENT 60 ELEMENTS OF GE 73.3%
EXTERNAL ELEMENTS OF GE = 16 REPRESENTED OF 60 GE ELEMENTS 26.6%

The above data were compared against an important transcendent theory in management issues: Pareto Principle (80/20): This principle defines, literally, that 80% of the results come from 20% of the dedicated efforts. That 20% of the causes cause 80% of the consequences. That 20% of the effort generates 80% of the results [12]. As can be seen in the present result, we clearly see that 73.3% of the elements of GE come from the internal management carried out by the managers of the companies, if you work on it, it will be possible to demonstrate the level of GE in the organizations.

IV. DISCUSSION

The International Organization for Standardization (ISO) is an institution that promotes standardization and has proposed standards that have established a reference in energy management systems. It even proposes mechanisms to perform energy measurements. The challenge is to put this standard into practice [11]. On the other hand, according to the ISO survey of certifications to management system standards - Complete results, in 2016, 1559 companies in Mexico from a total of 18882 companies in Latin America were certified under ISO 14001. While for ISO 50001, there were only 18 companies in 154 certified companies in all of Latin America.

According to the General Energy Balance presented by the Secretary of Energy, in Mexico the sectors that consume the most energy are: transport, which is the most intensive sector in energy use, representing 46.8%; the industrialist, who consumed 31.7%; residential, commercial and public with 18.1%; and agriculture, with 3.4%. Speaking properly of the industrial sector that during 2016 reached 31.7% of total energy consumption, this presented an increase of 4.9% over 2015, and it has been observed that the own increases of energy consumption comparing the year 2015 with the 2016 were: 6.5% of dry gas, electricity 4.0% and the consumption of petroleum (liquefied gas, gasoline and naphthas, diesel kerosene, and fuel oil) They increased 16.5% [13].

By itself, the SGE_n does not generate savings. An energy management system helps us detect areas of opportunity to save resources, but if the organization does not act and modifies its standards and processes based on that information, the savings will not be generated spontaneously. Therefore, governments must reinforce their dissemination strategy that allows for important contributions [14].

The SGE_n is a tool that will facilitate the operation of a program of continuous improvement and rapid response. If this program is applied with consistency and in a rigorous manner, then the organization could well contemplate a saving of between 5 and 10% in its energy expenses. If you also implement energy efficiency technologies or equipment such as high efficiency motors, variable speed drives, efficient and intelligent compressed air HVAC systems, natural lighting and LEDs, we could reach levels between 10 and 20% in energy costs savings. all kinds (not only electric, also thermal: cauldrons, burners, steam systems, etc.) [15]. It is demonstrated that for companies to achieve energy savings and efficiencies, they must include energy management within the overall management of the company, thereby obtaining a continuous improvement of consumption models and production processes.

IV. CONCLUSION

The energy inputs of a company have a very important role within the total resources needed for the production of goods and services, no matter what the economic activity that is performed, therefore, becomes a key section of analysis to achieve proper management. As it was possible to demonstrate in the present work, most of the elements of GE that were presented are of internal character attributable to the administrators of the companies. If you want to save on energy, it is advisable to look at this list of GE elements and start making the effort to work on the internal elements of GE, so that later we can demonstrate that we are on the best path to the proper use of the energy and that energy efficiency is being achieved. In the particular case of SME companies in Mexico, which are the majority and many have economic problems, you can see the great need to work and promote energy management projects that develop effective Energy Management Systems (SGE_n) since they are recommendable in any company or entity, (not only in those of great size), and in any sector of activity, for that reason they are being more and more demanded. Finally, make use of this proposal along with any of the existing tools or models for the proper development of GE.

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